

Fig. 1

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$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix}$$

Fig. 2

$$\begin{aligned} A &= \begin{bmatrix} A_0 \\ B_0 \end{bmatrix} \begin{bmatrix} A_1 \\ B_1 \end{bmatrix} \begin{bmatrix} A_2 \\ B_2 \end{bmatrix} \begin{bmatrix} A_3 \\ B_3 \end{bmatrix} \\ B &= \begin{bmatrix} C_0 \\ C_0 \end{bmatrix} \begin{bmatrix} C_1 \\ C_1 \end{bmatrix} \begin{bmatrix} C_2 \\ C_2 \end{bmatrix} \begin{bmatrix} C_3 \\ C_3 \end{bmatrix} \\ C &= \begin{bmatrix} D_0 \\ D_0 \end{bmatrix} \begin{bmatrix} D_1 \\ D_1 \end{bmatrix} \begin{bmatrix} D_2 \\ D_2 \end{bmatrix} \begin{bmatrix} D_3 \\ D_3 \end{bmatrix} \\ D &= \begin{bmatrix} D_0 \\ D_0 \end{bmatrix} \begin{bmatrix} D_1 \\ D_1 \end{bmatrix} \begin{bmatrix} D_2 \\ D_2 \end{bmatrix} \begin{bmatrix} D_3 \\ D_3 \end{bmatrix} \end{aligned}$$

Fi. 3.

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(a)

$$\begin{aligned} A &= (a_0, a_1, \dots, a_N) \\ B &= (b_0, b_1, \dots, b_N) \\ C &= (c_0, c_1, \dots, c_N) \\ D &= (d_0, d_1, \dots, d_N) \end{aligned}$$

$$\begin{bmatrix} A, 0, \dots, 0, A, 0, \dots, 0, A, 0, \dots, 0, A, 0, \dots, 0 \\ B, 0, \dots, 0, -B, 0, \dots, 0, B, 0, \dots, 0, -B, 0, \dots, 0 \\ C, 0, \dots, 0, C, 0, \dots, 0, -C, 0, \dots, 0, -C, 0, \dots, 0 \\ D, 0, \dots, 0, -D, 0, \dots, 0, -D, 0, \dots, 0, D, 0, \dots, 0 \end{bmatrix}$$

(b)

$$\begin{aligned} A &= (a_0, a_1, \dots, a_{N-1}, 0, \dots, 0) \\ B &= (b_0, b_1, \dots, b_{N-1}, 0, \dots, 0) \\ C &= (c_0, c_1, \dots, c_{N-1}, 0, \dots, 0) \\ D &= (d_0, d_1, \dots, d_{N-1}, 0, \dots, 0) \end{aligned}$$

$$\begin{bmatrix} A, A, A, A \\ B, -B, B, -B \\ C, C, -C, -C \\ D, -D, -D, D \end{bmatrix}$$

Fig. 4

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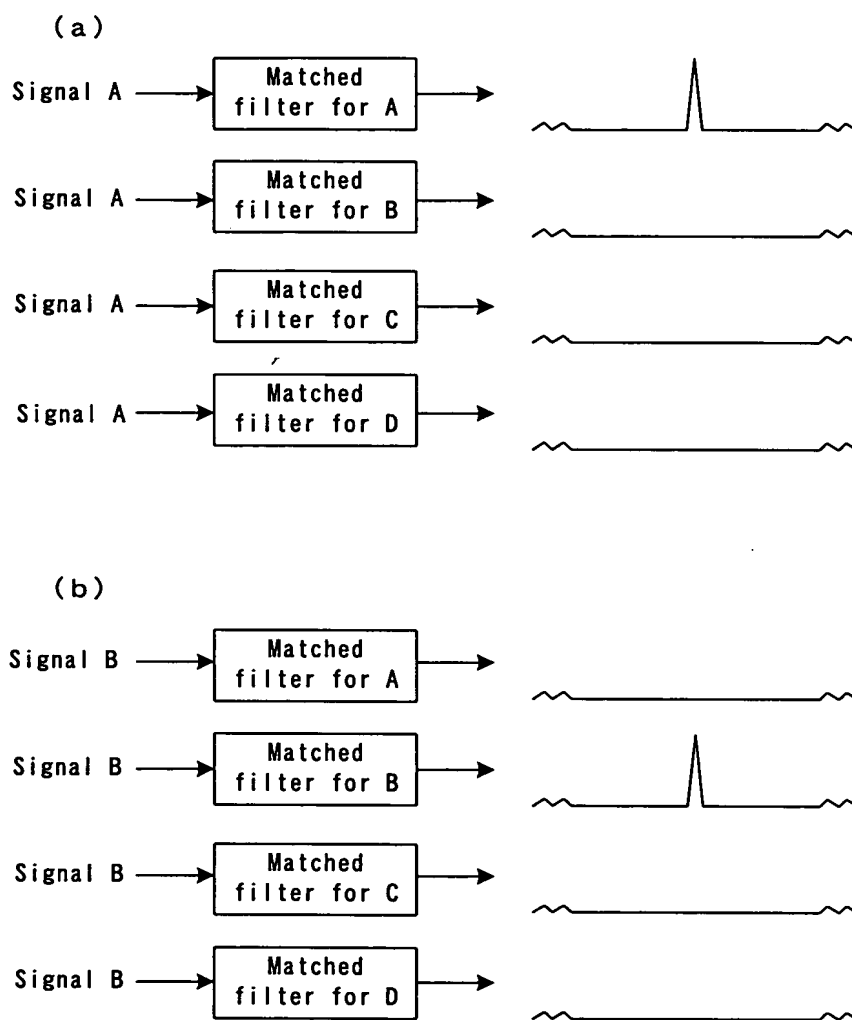


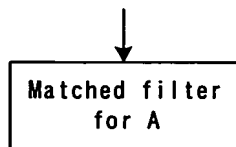
Fig. 5

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(a)

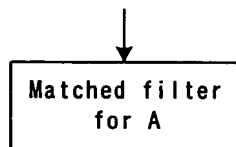
Signal A 100000000100000000100000000100000000



...00300000000400000000300000000200000000...

(b)

Signal B 100000000-100000000-100000000100000000



...00-000000000000000000-100000000000000000...

Fig. 6

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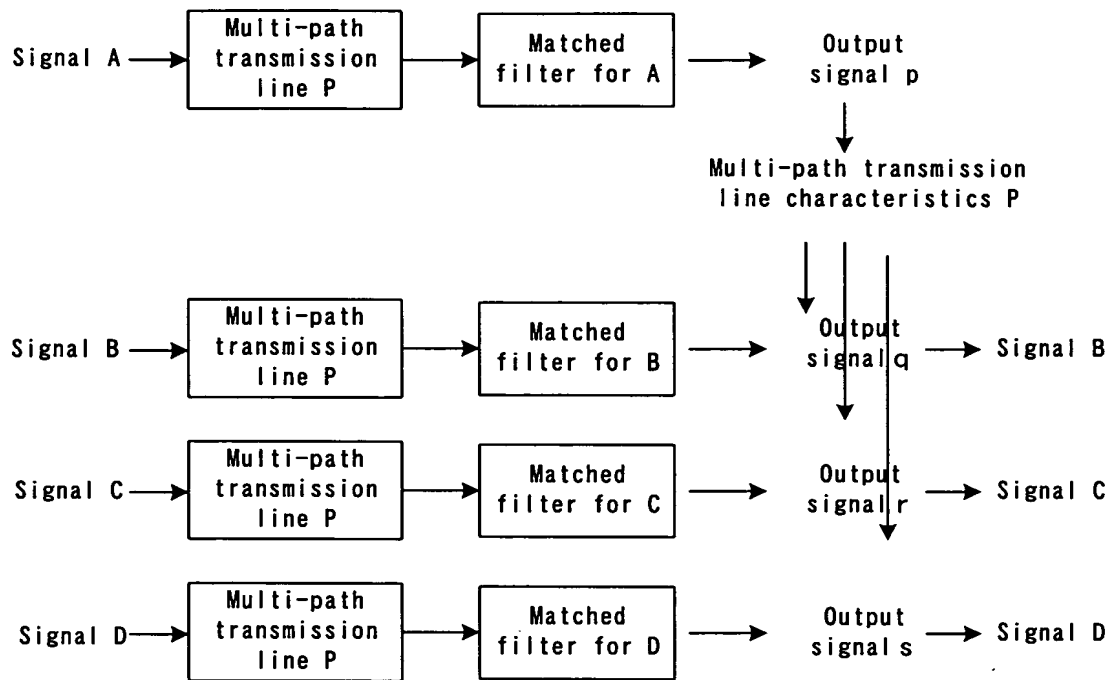


Fig. 7

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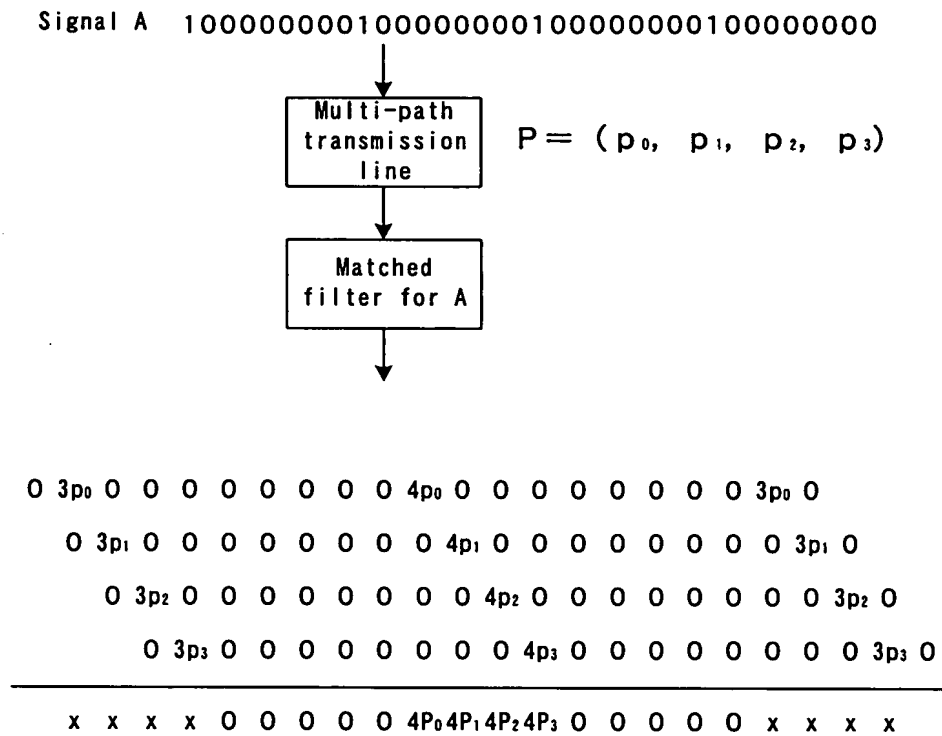


Fig. 8

(a) Transmission data (b_0 b_1 b_2 b_3 b_4 b_5)

(b)
$$B = (B_0)_0 + (B_1)_1 + (B_2)_2 + (B_3)_3$$

= (1 0 0 0 0 0 0 0 -1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 -1 0 0 0 0 0 0 0 0)

(c) Transmission signal

b_0	(1 0 0 0 0 0 0 0 -1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 -1 0 0 0 0 0 0 0 0)
$+ b_1$	(0 1 0 0 0 0 0 0 0 -1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 -1 0 0 0 0 0 0 0 0)
$+ b_2$	(0 0 1 0 0 0 0 0 0 -1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 -1 0 0 0 0 0 0 0 0)
$+ b_3$	(0 0 0 1 0 0 0 0 0 0 -1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 -1 0 0 0 0 0 0 0 0)
$+ b_4$	(0 0 0 0 1 0 0 0 0 0 0 -1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 -1 0 0 0 0 0 0 0 0)
$+ b_5$	(0 0 0 0 0 1 0 0 0 0 0 0 -1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 -1 0 0 0 0 0 0 0 0)

b_0 b_1 b_2 b_3 b_4 b_5 0 0 0 - ($b_0 b_1$ b_2 b_3 b_4 b_5) 0 0 0 b_0 b_1 b_2 b_3 b_4 b_5 0 0 0 - ($b_0 b_1$ b_2 b_3 b_4 b_5) 0 0 0 ...

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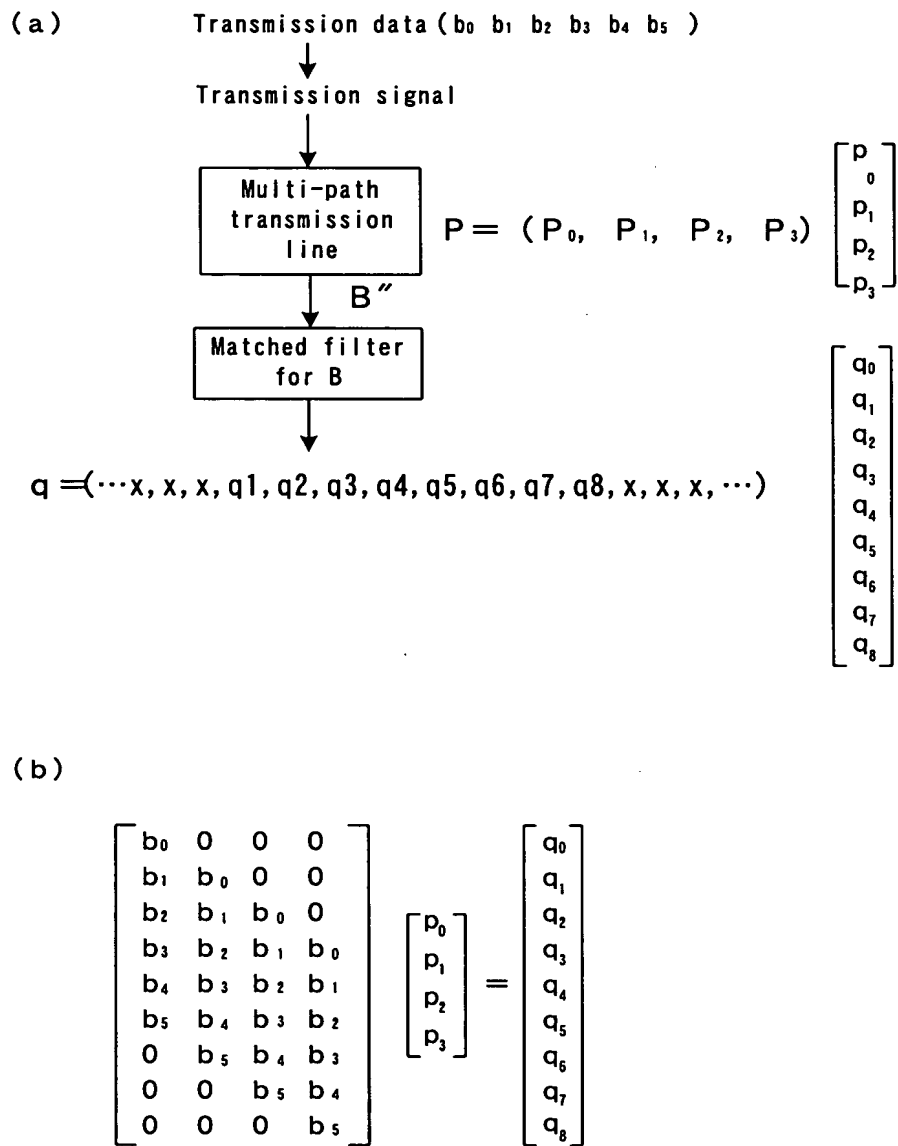
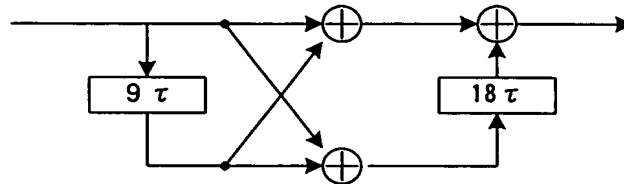


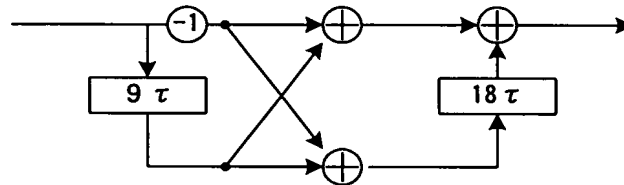
Fig. 10

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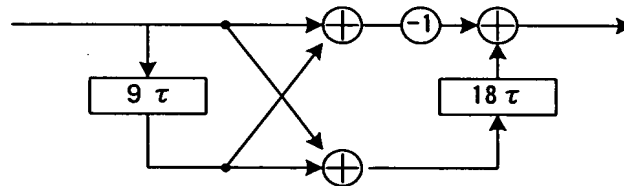
(a) Matched filter for A



(b) Matched filter for B



(c) Matched filter for C



(d) Matched filter for D

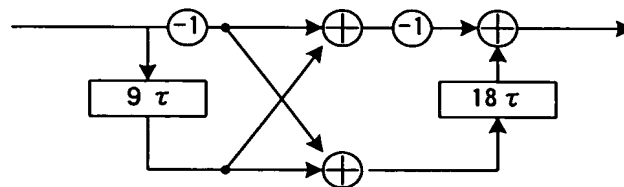


Fig. 11

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$$A_0 = (+ + + - + + - +)$$

$$\begin{array}{cccccccc} + & + & + & - & + & + & - & + \\ & + & + & + & - & + & + & - & + \\ & & + & + & + & - & + & + & - & + \\ \hline & & & 1 & 2 & 3 & 1 & 1 & 1 & 1 & 0 & 1 \end{array}$$

Fig. 12